Original Article

DOI: 10.38053/acmj.1592255

ANATOLIAN CURRENT MEDICAL

Anatolian Curr Med J. 2025;7(1):54-59

Odontogenic and non-odontogenic cysts in the jaws: a retrospective analysis

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Cite this article as: Çoban E, Altay B, Chodarov A. Odontogenic and non-odontogenic cysts in the jaws: a retrospective analysis. *Anatolian Curr Med J.* 2025;7(1):54-59.

Received: 27.11.2024 ◆ **Accepted**: 18.12.2024 ◆ **Published**: 10.01.2025

ABSTRACT

Aims: This study aims to retrospectively analyze the demographic, clinical, and radiological characteristics of jaw cysts and evaluate the implications of these findings for accurate diagnosis, effective treatment planning, and the prevention of potential complications.

Methods: This retrospective cross-sectional study was conducted at the Kırıkkale University Oral and Maxillofacial Surgery Clinic between April 2023 and May 2024. A total of 178 patients, histopathologically diagnosed with jaw cysts, were included. Data on demographic factors such as age and gender, as well as clinical and radiological features of the cysts, were collected and analyzed.

Results: The mean age of the patients was 48.52±16.56 years, with 56.74% of the cohort being male and 43.25% female. The distribution of lesions was as follows: 53.93% in the mandible, 43.82% in the maxilla, and 2.25% in both jaws. Radiologically, 79.77% of the lesions were radiolucent, while 20.22% exhibited a mixed radiological pattern. Clinically, 86.52% of the lesions were asymptomatic, while 13.48% were symptomatic. The most prevalent cyst types identified were radicular cysts (35.4%), dentigerous cysts (19.1%), and keratocysts (19.1%).

Conclusion: A comprehensive analysis of the demographic and radiological characteristics of jaw cysts plays a pivotal role in achieving precise diagnoses and devising effective treatment strategies. The present study shows that radicular cysts are the most common type, which is consistent with previous studies. However, the findings indicate a lower prevalence of radicular cysts compared to other studies focusing on cystic lesions. Moreover, this study reports higher prevalence rates for dentigerous cysts and keratocysts compared to certain other studies. These findings emphasize the importance of accounting for individual and population-based variability when diagnosing and managing jaw cysts.

Keywords: Jaw cysts, odontogenic cysts, non-odontogenic cysts, retrospective analysis

INTRODUCTION

Odontogenic and non-odontogenic cysts constitute a diverse category of pathological conditions that impact the oral and maxillofacial region. These lesions generally emerge from a range of developmental and inflammatory mechanisms, closely tied to the distinct anatomical and biological features of the jaws. While odontogenic cysts stem from epithelial remnants related to tooth development, non-odontogenic cysts originate from ectodermal tissues involved in craniofacial formation.[1] The most prevalent types of odontogenic cysts include periapical (radicular) cysts, dentigerous cysts, and odontogenic keratocysts.[2] Extensive epidemiological research has highlighted the distribution and clinical behavior of odontogenic cysts, with a particular focus on the more aggressive and destructive variants.[2]

The 2017 classification by the World Health Organization (WHO) serves as a detailed framework for distinguishing between odontogenic and non-odontogenic cysts. Odontogenic cysts are classified into two main types: inflammatory and developmental.[3] Inflammatory cysts encompass radicular cysts, which develop as a consequence of pulp inflammation, and residual cysts, which remain following tooth extraction. Developmental cysts, including dentigerous cysts, odontogenic keratocysts, and lateral periodontal cysts, were also classified under this system and result from interruptions in the normal processes of tooth development.[1,3] Non-odontogenic cysts, including nasopalatine duct cysts and nasolabial cysts, are less frequently encountered and arise from epithelial remnants of embryological structures.[3] Notably, the revised classification redefined keratocystic odontogenic tumors and calcifying epithelial odontogenic tumors as cysts. However, some odontogenic and non-odontogenic cysts were excluded from the classification, potentially leading to diagnostic ambiguities. For example, gingival cysts were incorporated

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into the classification, while others, such as nasolabial cysts, were omitted.[4]

The etiology of jaw cysts is multifactorial, encompassing genetic predisposition, environmental influences, and local inflammatory processes.[5,6] Odontogenic cysts commonly arise due to chronic inflammatory stimuli, such as untreated dental caries or trauma, which lead to epithelial proliferation.[1,7] Conversely, non-odontogenic cysts are often associated with developmental abnormalities.[2,3] The pathogenesis of these lesions reflects their origin, with odontogenic cysts linked to the remnants of the tooth-forming apparatus and non-odontogenic cysts stemming from embryonic epithelial residues. The pathogenesis of these lesions mirrors their origin: odontogenic cysts are linked to remnants of the tooth-forming apparatus, while non-odontogenic cysts originate from epithelial residues of embryonic structures.[3,7]

Jaw cysts are reported to be more common in males than females, with a male-to-female ratio of 1.6:1. They predominantly occur in individuals aged between the fourth and sixth decades of life. Odontogenic cysts are frequently located in the anterior maxilla, followed by the posterior mandible.[8] Due to the overlapping clinical and radiological features of these cysts, misdiagnoses are common. Consequently, precise evaluation of clinical and radiological findings is critical for accurate diagnosis.[1] Definitive diagnosis often requires histopathological examination, as clinical and radiological findings alone may not suffice. Certain cysts, particularly those with aggressive behavior and high recurrence potential, demand careful identification and management.[7]

In most cases, cysts are asymptomatic unless secondary infection occurs. When symptomatic, clinical presentations may include dental and gingival issues, intraoral discharge, bad taste, and painless swelling. In severe cases, complications such as trismus, sensory deficits, and pathological fractures may develop.[9] Surgical interventions, including enucleation, curettage, and marsupialization, are commonly employed in the treatment of jaw cysts. The choice of treatment should be tailored based on the type and aggressiveness of the cyst.[1,9] These interventions not only help control the lesion but also reduce the risk of recurrence. Thus, the accurate identification and effective management of jaw cysts require meticulous clinical and histopathological evaluation.[1,9]

The aim of this study is to retrospectively analyze the distribution of demographic data, such as age and gender, as well as the radiological and clinical characteristics of jaw cysts in a total of 178 patients who were histologically diagnosed with jaw cysts. The information obtained regarding the diagnosis and distribution of jaw cysts may contribute to the literature by facilitating accurate treatment planning and preventing potential complications.

METHODS

This research was designed as a retrospective cross-sectional study, encompassing patients who were histopathologically diagnosed with odontogenic and non-odontogenic jaw cysts. The study was conducted at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Kırıkkale University. Ethical approval was granted by the Kırıkkale University Non-interventional Clinical Researches Ethics Committee (Date: 26.06.2024, Decision Number: 2024/06-19). The study adhered strictly to the principles outlined in the Helsinki Declaration of Human Rights. Patients who presented to the Oral and Maxillofacial Surgery Clinic between April 2023 and May 2024 were retrospectively reviewed. Demographic data, including age and gender, along with the radiological and clinical characteristics of the jaw cysts, were systematically collected and analyzed. The inclusion criteria focused on cases with complete clinical, radiological, and histopathological records, ensuring comprehensive data integrity.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics version 29 software. Descriptive statistics, such as mean and standard deviation, were employed to summarize numerical variables. For categorical variables, chi-square tests were utilized to assess variations across groups. The Mann-Whitney U test was conducted for non-parametric within-group comparisons. Additionally, relationship coefficients, including Phi, Cramer's V, Contingency Coefficient, Eta, and Gamma, were calculated to evaluate the strength and direction of associations between variables. A significance level of $p<0.05$ was set for all statistical tests.

RESULTS

The study included a total of 178 patients, with ages ranging from 18 to 75 years and a mean age of 48.52±16.56 years. Of these, 56.74% (n=101) were male, and 43.25% (n=77) were female. The anatomical distribution of lesions revealed that 53.93% (n=96) were in the mandible, 43.82% (n=78) in the maxilla, and 2.25% (n=4) in both jaws. Radiological analysis indicated that 79.77% (n=142) of the lesions exhibited a radiolucent appearance, while 20.22% (n=36) demonstrated a mixed radiological pattern. Clinically, most lesions (86.52%, n=154) were asymptomatic, whereas 13.48% (n=24) presented with symptoms. Regarding lesion size, 39.33% (n=70) were less than or equal to 1 cm in diameter, and 60.67% (n=108) measured larger than 1 cm. Lesion margins were classified as regular in 85.19% (n=154) of cases and irregular in 14.81% (n=24) (**Table 1**).

Statistical analyses showed no significant association between gender and lesion location ($p=0.83$), radiological appearance ($p=0.71$), size ($p=0.31$), or margin characteristics ($p=0.3$). However, asymptomatic lesions were significantly more common in males than females ($p=0.0004$, $p<0.05$). Similarly, no statistically significant correlation was observed between age and lesion location ($p=0.49$), radiological appearance ($p=0.63$), symptomatology ($p=0.91$), size ($p=0.63$), or margin characteristics ($p=0.42$).

The pathological analysis identified 178 lesions, distributed as follows: radicular cysts (35.4%, n=63), dentigerous cysts (19.1%, n=34), odontogenic keratocysts (19.1%, n=34), lateral periodontal cysts (12.4%, n=22), nasopalatine duct cysts (4.49%, n=8), buccal bifurcation cysts (1.1%, n=2), glandular odontogenic cysts (1.1%, n=2), nasolabial cysts (2.8%, n=5), orthokeratinized odontogenic cysts (2.2%, n=4), and calcifying odontogenic cysts (2.2%, n=4) (**Figure**).

Table 1. Demographic and clinical characteristics of the patients included in the study

Characteristic	Value	Patients (%)	Patients (n)
Mean age	48.52±16.56	-	-
Gender	Male	56.74	101
	Female	43.25	77
Location of lesions	Maxilla	43.82	78
	Mandible	53.93	96
	Both jaws	2.25	4
Radiological appearance of lesions	Radiolucent	79.77	142
	Mixed	20.22	36
Clinical status of lesions	Asymptomatic	86.52	154
	Symptomatic	13.48	24
Size of lesions	≤1 cm	39.33	70
	>1 cm	60.67	108
Borders of lesions	Regular	85.19	154
	Irregular	14.81	24

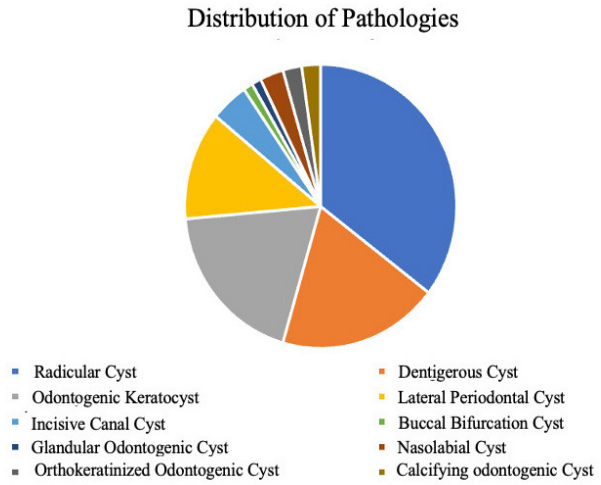

Figure 1. Distribution of pathologies

The mean age of patients with radicular cysts was 42.17±18.04 years. Among them, 64.49% (n=40) were male, and 36.5% (n=23) were female. The mean age of patients with dentigerous cysts was 45.84±17.10 years, with 52.9% (n=18) being male and 47.1% (n=16) female. For odontogenic keratocysts, the mean age was 47.76±15.4 years, with 52.9% (n=18) male and 47.1% (n=16) female. Patients with lateral periodontal cysts had a mean age of 38.36±13.13 years, with 40.9% (n=9) being male and 59.09% (n=13) female. The mean age of patients with nasopalatine duct cysts was 62.5±17.3 years, with 75% (n=6) being male and 25% (n=2) female. For nasolabial cysts, the mean age was 55.3±2.8 years, with 60% (n=3) being male and 40% (n=2) female. Patients with orthokeratinized odontogenic cysts had a mean age of 38.5±15.58 years, with 75% (n=3) being male and 25% (n=1) female. The mean age of patients with calcifying odontogenic cysts was 43.5±21.36 years, with 25% (n=1) male and 75% (n=3) female. For glandular odontogenic cysts, the mean age was 52.5±13.43 years, with 50% (n=1) male and 50% (n=1) female. Patients with buccal bifurcation cysts had a mean age of 42.5±12.72 years, and all cases (100%, n=2) were male (**Table 2**).

DISCUSSION

Jaw cysts are among the most common causes of chronic swelling in the maxillofacial region, owing to the high density of odontogenic epithelial remnants present in oral tissues.[10] These epithelial residues serve as the origin of odontogenic cysts, which constitute the majority of cystic lesions observed in the jaws.[1,8] Jaw cysts often share overlapping clinical, radiological, and histopathological characteristics, making accurate diagnosis critical. This is especially important for odontogenic cysts with a high likelihood of recurrence and aggressive behavior.[1,9] This retrospective study analyzed patients diagnosed with odontogenic and non-odontogenic jaw cysts at the Department of Oral and Maxillofacial Surgery, Kırıkkale University Faculty of Dentistry, over a one-year period. The analysis encompassed key demographic variables such as age and gender, as well as the clinical and radiological profiles of the identified cysts.

Age is a determining factor in the distribution of jaw cysts. The existing literature indicates that jaw cysts are predominantly observed in middle-aged populations; however, variations among studies highlight discrepancies in age-related patterns.[1,7,8,11] For instance, Tamiolakis et al.[8] reported an average patient age of 42.3 years, with radicular cysts most frequently observed in individuals aged between the fourth and sixth decades. Conversely, Öner et al.[11] noted a predominance of young adults, with an average age of 38.34 years. Similarly, Tekkesin et al.[7] identified an average age of 36.33 years, with radicular cysts occurring at a mean

Table 2. Demographic characteristics by pathology type

Pathology type	Patients	Patients	Mean age (years) (±SD)	Male (%)	Female (%)
Radicular cyst	63	35.4%	42.17±18.04	64.49% (n:40)	36.5% (n:23)
Dentigerous cyst	34	19.1%	45.84±17.10	52.9% (n:18)	47.1% (n:16)
Odontogenic keratocyst	34	19.1%	47.76±15.4	52.9% (n:18)	47.1% (n:16)
Lateral periodontal cyst	22	12.4%	38.36±13.13	40.9% (n:9)	59.09% (n:13)
Incisive canal cyst (nasopalatine cyst)	8	4.49%	62.5±17.3	75% (n:6)	25% (n:2)
Nasolabial cyst	5	2.8%	55.3±2.8	60% (n:3)	40% (n:2)
Orthokeratinized odontogenic cyst	4	2.2%	38.5±15.58	75% (n:3)	25% (n:1)
Calcifying odontogenic cyst	4	2.2%	43.5±21.36	25% (n:1)	75% (n:3)
Glandular odontogenic cyst	2	1.1%	52.5±13.43	50% (n:1)	50% (n:1)
Buccal bifurcation cyst	2	1.1%	42.5±12.72	100% (n:2)	0% (n:0)

SD: Standard deviation

age of 33.7 years. In contrast to these studies, the present study found a mean patient age of 48.52 years, with radicular cysts occurring at a mean age of 42.17 years, indicating an older population. This discrepancy may be attributed to the higher prevalence of residual cysts among older individuals, often linked to post-extraction complications. Supporting this notion, Demirkol et al.[5] reported that residual cysts are predominantly observed in elderly populations, likely due to the increased frequency of tooth extractions in these age groups. This situation is supported by the current study data; it is thought that residual cysts may affect the age distribution. In agreement with present study findings, Du et al.[12] observed a higher prevalence of radicular cysts among middle-aged and older populations, emphasizing the role of chronic inflammatory processes and delayed treatment in this age group.

Gender distribution is a significant determinant in the demographics of jaw cysts. The literature consistently reports a higher prevalence of jaw cysts in males compared to females.[5,7,8,13] In a study by Tamiolakis et al.[8] the male-to-female ratio was reported as 1.6:1. Similarly, Tekkesin et al.[7] identified a male-to-female ratio of 1.36:1, emphasizing the higher prevalence of cysts in males. Two independent studies conducted in Turkey yielded comparable results, reporting a male-to-female ratio of 1.4:1.[5,13] In a systematic review by Johnson et al.[2] it was noted that the male predominance was particularly pronounced for radicular cysts, whereas dentigerous cysts exhibited a higher prevalence in females. Lo Muzio et al.[6] attributed the higher prevalence of radicular cysts in males to environmental and genetic factors that influence inflammatory processes, particularly around the apical regions of teeth, where epithelial remnants of Malassez are stimulated.[6,14] In the present study also demonstrated a higher prevalence of jaw cysts in males compared to females, consistent with the literature. Radicular cysts, dentigerous cysts, and odontogenic keratocysts were more frequently observed in males than in females. This trend may be attributed to untreated dental caries and trauma, which are more common in males, potentially reflecting population-specific characteristics.[15] Factors such as oral hygiene habits and susceptibility to trauma within the studied population may contribute to these gender-based differences. This finding is further supported by Mutinda et al.[16] who reported a male predominance in their 20-year analysis of odontogenic cysts, underscoring similar environmental and genetic factors contributing to this trend.

Anatomical location plays a critical role in the diagnosis and differential diagnosis of jaw cysts.[1,2,8] However, the literature presents varying ratios of maxilla-to-mandible involvement.[2,5,7,8] In a study conducted by Tamiolakis et al.[8] an equal distribution of cysts between the maxilla and mandible was reported. Radicular cysts were more frequently observed in the anterior region of the maxilla, whereas dentigerous cysts and keratocysts were predominantly located in the posterior region of the mandible. In contrast, Tekkesin et al.[7] found that the maxilla was more frequently affected (53.09%) compared to the mandible (46.91%). Similarly, Baştoklu et al.[13] reported a higher prevalence of cysts in the mandible (58.1%) compared to the maxilla. Conversely, Demirkol et al.[5] noted that the maxilla was more commonly involved (53.7%) than the mandible. In the present study, the mandible was found to be more frequently affected, with a prevalence of 53.93%. This finding may be associated with the mandible's increased exposure to masticatory forces, leading to a higher susceptibility to trauma.[15] It is important to note, however, that the anatomical distribution may vary depending on the specific type of cyst, which can influence the overall prevalence patterns.[2] Present study findings align with Du et al.[12] who also reported a higher prevalence of odontogenic cysts in the mandibular region, particularly odontogenic keratocysts, due to their association with impacted molars and developmental disturbances.

Radiological features play a critical role in the diagnosis of jaw cysts.[1] For instance, the multilocular appearance and aggressive nature of odontogenic keratocysts are significant criteria for their differentiation from other cysts.[2] Cysts with irregular margins and large radiolucent areas are known to be associated with biological aggressiveness.[1] In the study by Tamiolakis et al.[8] it was reported that most cysts exhibited regular margins and a radiolucent appearance. Similarly, Tekkesin et al.[7] noted that the majority of cysts displayed regular margins and radiolucent characteristics. In the present study, 85.19% of the lesions were found to have regular margins, and 59.55% demonstrated a radiolucent appearance, findings that are consistent with the literature.

Radicular cysts are the most common inflammatory lesions among jaw cysts, typically developing as a result of pulpitis or periapical infections.[17] In a study conducted by Jones and Franklin[18] in the United Kingdom, involving 6,164 cases, the prevalence of radicular cysts was reported as 52.4%. Similarly, Tamiolakis et al.[8] reported the prevalence of radicular cysts as 57.3% in their study. Baştoklu et al.[13] in their research conducted in the Konya region, documented a prevalence of 54.7%, consistent with the literature . Demirkol et al.[5] emphasized that radicular cysts, with a prevalence of 63%, are the most frequently observed cyst type. Globally, radicular cysts are recognized as the predominant odontogenic cysts, with an estimated prevalence of 54.6%.[2] In the present study, radicular cysts accounted for 35.4% of cases, representing a lower prevalence compared to other studies. Nevertheless, they remained the most frequently observed cyst type, aligning with the literature. This discrepancy may be attributed to variations in dental hygiene practices or diagnostic approaches across different populations. Baştoklu et al.[13] reported a wide age range for radicular cysts, spanning 12–76 years, with a mean age of 35, in their study conducted in the Konya region. Similarly, a study from the Gaziantep region noted that radicular cysts were most frequently observed in individuals in their third and fourth decades.[5] In the present study, the mean age for radicular cysts was found to be 42.17 years, which is consistent with the 41.2 years reported by Tamiolakis et al.[8] These variations may be explained by population-specific factors such as differences in oral hygiene habits and susceptibility to trauma, which can influence the age distribution and prevalence of radicular cysts. Similarly, Mutinda et al.[16] highlighted that

regional factors and healthcare accessibility may contribute to variations in cyst prevalence across populations, further explaining discrepancies in global findings.

Dentigerous cysts are developmental in origin and represent the second most common type of odontogenic cysts.[1] They are most frequently associated with impacted teeth, particularly mandibular third molars.[19] Studies in the literature report varying prevalence rates for dentigerous cysts.[2,5,7,13] A study conducted in the Istanbul region reported a prevalence of 10.39%, while the prevalence in the Konya region was reported as 17.8%.[7,13] In contrast, a study from the Gaziantep region reported a higher prevalence of 26.9%, exceeding typical literature values.[5] In a systematic review by Johnson et al.[2] the global prevalence of dentigerous cysts was estimated at 20.6%. In the present study, the prevalence of dentigerous cysts was found to be 19.1%, making them the second most frequently observed cyst type. This finding is consistent with the global prevalence reported in the literature.

Odontogenic keratocysts hold particular significance due to their biologically aggressive nature and high recurrence rates. They are most commonly observed in the posterior region of the mandible.[1] In a study by Tamiolakis et al.[8] the prevalence of keratocysts was reported as 8.2%. Baştoklu et al.[13] in their study conducted in the Konya region, documented a prevalence of 12.4%. On the other hand, Demirkol et al.[5] reported a lower prevalence of 6.1% in the Gaziantep region. In a global systematic review, Johnson et al.[2] estimated the prevalence of odontogenic keratocysts to be 11.7%. In the present study, the prevalence of keratocysts was found to be 19.1%, equal to that of dentigerous cysts, and higher than the rates reported in most previous studies. However, our findings align with the study by Tekkesin et al.[7] conducted in Istanbul, where the prevalence of keratocysts was reported as 20.6%.

Limitations

This study has several limitations that should be considered. First, as a single-center study, the generalizability of the findings is limited. More comprehensive results could be achieved by incorporating data from different geographical regions and institutions. Additionally, the limited number of patients included in the study, the lack of long-term follow-up data, and the inability to evaluate treatment approaches and recurrence rates are notable constraints. Another limitation is that histopathological analyses were not conducted at a centralized facility, which may have introduced variability in the findings. Furthermore, the retrospective study design covering only a one-year period may not provide sufficient time to collect reliable epidemiological data, which further limits the robustness of the findings.

CONCLUSION

The present study shows that radicular cysts are the most common type, which is consistent with previous studies. However, the findings indicate a lower prevalence of radicular cysts compared to other studies focusing on cystic lesions. Moreover, this study reports higher prevalence rates for dentigerous cysts and keratocysts compared to certain other studies. These differences may be attributed to variables such as the demographic characteristics of the population, environmental factors, and dental health practices. In conclusion, early diagnosis and appropriate treatment approaches are crucial for the effective management of radicular cysts and other cystic lesions. The variations in regional prevalence rates underscore the importance of considering local dynamics during clinical evaluation processes. Furthermore, the prevention and management of jaw cysts heavily rely on regular dental check-ups, the improvement of oral hygiene practices, and raising awareness within the community, all of which play a critical role in promoting dental health. Additionally, present study findings revealed that jaw cysts were more prevalent in males compared to females, with a peak incidence in middle-aged individuals. This highlights the influence of age and gender on cyst distribution, emphasizing the need for targeted preventive measures in these populations. In this context, future studies expanding prevalence data across diverse populations could significantly contribute to the development of more effective strategies for the treatment and prevention of jaw cysts.

ETHICAL DECLARATIONS

Ethics Committee Approval

The study was carried out with the permission of Kırıkkale University Non-interventional Clinical Researches Ethics Committee (Date: 26.06.2024, Decision No: 2024/06-19).

Informed Consent

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process

Externally peer reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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